

6
PUBLIC HEALTH ACT.

(11 & 12 Vict., Cap. 63.)

R E P O R T

TO THE

GENERAL BOARD OF HEALTH

ON A

P R E L I M I N A R Y I N Q U I R Y

INTO THE SEWERAGE, DRAINAGE, AND SUPPLY OF
WATER, AND THE SANITARY CONDITION

OF THE TOWNSHIP OF

B R O U G H T O N ,

IN THE COUNTY PALATINE OF LANCASTER.

By ROBERT RAWLINSON, Esq., C.E.,

SUPERINTENDING INSPECTOR.



LONDON:

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NOTIFICATION.

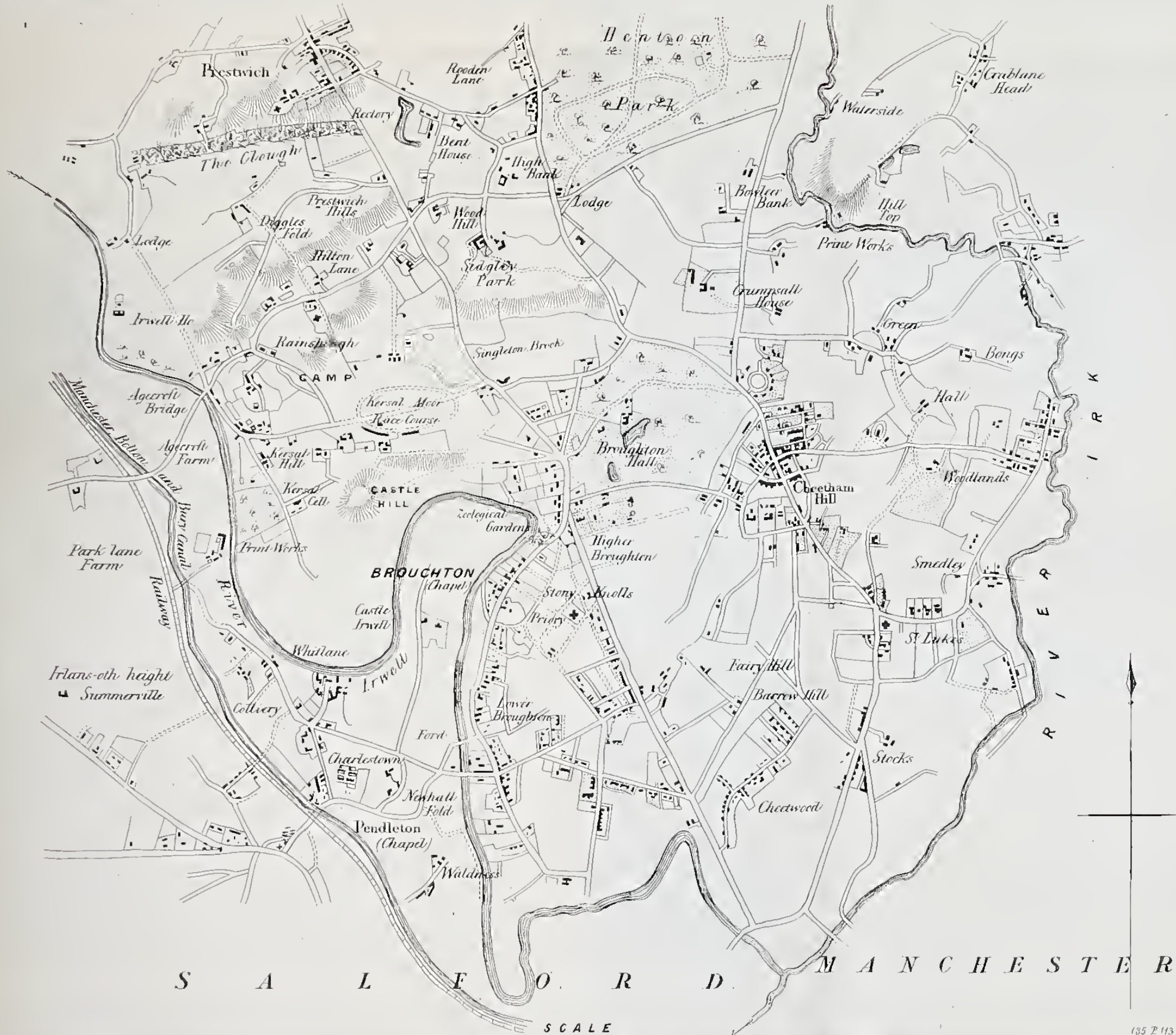
THE General Board of Health hereby give notice, in terms of section 9th of the Public Health Act, that on or before the 5th day of December next, being a period of not less than one month from the date of the publication and deposit hereof, written statements may be forwarded to the Board with respect to any matter contained in or omitted from the accompanying Report on the Sewerage, Drainage and Supply of Water, and the Sanitary Condition of the Inhabitants of the Township of BROUGHTON, or with respect to any amendments to be proposed therein.

By order of the Board,

HENRY AUSTIN, *Secretary*.

Gwydyr House, Whitehall;
19th October, 1850.

BROUGHTON.



S A L F O R D M A N C H E S T E R



1 Mile



TABLE OF CONTENTS.

	PAGE
Names of Persons who attended the Inquiry	4
Preamble of Petition	5
General outline of Report	5
Broughton Township, &c.	6
Local Government required	7
Table of Population, &c.	7
Acts of Parliament	7
Mortality	7
Geology	8
Meteorology	10
Table of Rain-fall	10
Present state and condition of the Township	11
Existing Sewerage and Drainage	12
Cesspools	12
Existing Water Supply	13
Analysis of Water	13
Lighting	14
Burial Grounds	14

REMEDIAL WORKS PROPOSED.

Sewerage and Drainage	14
Branch Sewers and House-drains	16
Table of Power used, and Cost of Draining by Pumping in Fen Districts	19
Remarks on ditto	19
Proposed Water Supply	20
Public Walks and Recreation Grounds	21
Summary of Conclusions and Recommendations	21
Appendix A	23
Appendix B	29
Remarks and Estimate for intercepting Drains, &c.	37

PUBLIC HEALTH ACT (11 and 12 Vict., cap. 63.)

Report to the General Board of Health on a Preliminary Inquiry as to the Sewerage, Drainage, and Supply of Water, and the Sanitary Condition of the Township of BROUGHTON, in the County Palatine of Lancaster. By ROBERT RAWLINSON, Esq. C.E., Superintending Inspector.

MY LORDS AND GENTLEMEN,

London, July 1850.

WHEREAS, in pursuance of the Public Health Act, 1848 your Honourable Board appointed for the purposes of that Act, have, upon a certain petition from 140 of the inhabitants rated to the relief of the poor of and within the township of Broughton, in the county of Lancaster, directed Robert Rawlinson, a Superintending Inspector appointed for the purposes of the Act, to visit the said township, and to make public inquiry and to examine witnesses as to the sewerage, drainage, and supply of water, the state of the burial grounds, the number and sanitary condition of the inhabitants, and as to any local Acts of Parliament in force within such township for paving, lighting, cleansing, watching, regulating, and supplying with water, or improving the said township, or having relation to the purposes of the Act; also as to the natural drainage-area; and the existing municipal, parochial, or other local boundaries and the boundaries which might be most advantageously adopted for the purposes of the said Act:—

Now I, Robert Rawlinson, having previously given the notice directed by the Act, proceeded upon the inquiry in the manner directed by the Act, and do report in writing to your Honourable Board upon the several matters with respect to which I was directed to inquire, and upon certain other matters in respect of which I deem it expedient to report for the purposes of the Public Health Act.

At the inquiry every required assistance was afforded by the gentlemen who attended; and the agent of Colonel Clowes stated that he was authorized to say that the Colonel wished that all necessary information should be furnished. The inquiry was attended by W. S. Rutter, Esq., solicitor, Messrs. Boardman, Priestly, Pennington, Tonge, Grave, Howarth, Blacklock, Lynch, Dr. Wood, and others.

PREAMBLE OF PETITION.—

“ PUBLIC HEALTH ACT.

Petition of the Inhabitants of the Township of Broughton, in the Parish of Manchester, and County of Lancaster, for application of the Act.

“ WHEREAS by the Public Health Act, 1848, it is enacted that from time to time, after the passing of that Act, upon the petition of not less than one-tenth of the inhabitants rated to the relief of the poor of any city, town, borough, parish, or place, having a known or defined boundary, not being less than 30 in the whole, the General Board of Health may, if and when they shall think fit, direct a Superintending Inspector to visit such city, town, borough, parish, or place, and to make public inquiry, and to examine witnesses as to the sewerage, drainage, and supply of water, the state of the burial-grounds, the number and sanitary condition of the inhabitants, and as to any local Acts of Parliament in force within such city, town, borough, parish, or place, for paving, lighting, cleansing, watching, regulating, supplying with water, or improving the same, or having relation to the purposes of this Act; also as to the natural drainage areas and the existing municipal, parochial, or other local boundaries, and the boundaries which may be most advantageously adopted for the purposes of this Act, and as to any other matters in respect whereof the said Board may desire to be informed, for the purpose of enabling them to judge of the propriety of reporting to Her Majesty, or making a provisional order as mentioned in the said Act:

“ Now, therefore, we, the undersigned inhabitants of the township of Broughton, in the county of Lancaster (the same township being a place having a known or defined boundary within the meaning of the said Act), being rated to the relief of the poor of and within that township, and being one-tenth in number of the inhabitants rated to the relief of the poor of and within the same township, do hereby petition the General Board of Health to direct a Superintending Inspector to visit the said township, and to make inquiry and examination with respect thereto, but more particularly with respect to that part thereof which is situate without the municipal borough of Salford, with a view to the application of the said Act to such last-mentioned part, according to the provisions of the said Act in that behalf.

(Signed) “ WILLIAM LEGH CLOWES, Broughton Old Hall.”
And 139 others.

GENERAL OUTLINE OF REPORT.—In the following Report evidence is given which will prove that the application of the Public Health Act may be made of great use as a means of regulating and improving the township of Broughton. Following upon this evidence, suggestions are furnished, detailing the particular class of improvements required; and such general remarks are embodied as are considered applicable to the district. The inhabitants of Broughton are not, in their dwelling-houses, to any great extent directly affected by the contaminating influences of the imperfect and most objectionable outlet drainage of Manchester and Salford; but as they are, for the most part, the business-men of Man-

chester and Salford, I have considered it necessary to enter into this question, as it is one which most deeply concerns every individual in the district. With much to admire and commend as to the energetic and beneficial mode in which the local government of both boroughs (Manchester and Salford) are administered, there exist the great evils of neglecting the sewerage and drainage at the outlets, and, to a great extent, at the inlets also. Existing local Acts may be stretched to individual persecution, but they are powerless for any great and efficient remedy. Public sewers and drains, of a secondary character, are constructed by the authorities; but private drains too frequently depend upon the will of owners of property, and their formation is neglected, partly from a want of knowledge how to construct them, and partly from a fear of expense. The result, however, is the same, they are neglected to the serious injury of the tenants and to the cost of the ratepayers generally, as crowded middens and foul cesspools are known to produce disease; this brings the poor upon the parish funds, and consequently increases the poor's-rates.

The construction of private drains should not remain a matter of choice; and a properly constituted local Board, with an efficient staff of skilled workmen, could best execute all sewers and drains at a minimum cost; and under the powers of the Public Health Act the repayment may be extended over a period not exceeding thirty years, thus relieving lessees, mortgagees, and minors.

BROUGHTON TOWNSHIP is situated in the parish of Manchester in the hundred of Salford, and in the county palatine of Lancaster $1\frac{1}{2}$ mile north-north-west of Manchester. It does not form any part of the borough of Manchester; but a portion of it is included in the borough of Salford. Until within a period extending only a few years back, Broughton was almost entirely an agricultural township. About the time of Queen Ann, Broughton-hall was the property of a Mr. Stanley, a descendant of one of the Earls of Derby, who bestowed it upon his (Mr. Stanley's) ancestor about the time of Queen Elizabeth; previous to the present century it became the property and the seat of Samuel Clowes, Esq.; and at present it belongs to Colonel Clowes, who is one of the largest landed proprietors in the neighbourhood. The township of Broughton comprises a district known as Higher Broughton and Lower Broughton, the village of Kersall, and Kersall Moor. Within the last 20 years the rental is said to have increased almost threefold. The land is principally freehold. There are in England 27 places, market-towns, parishes, townships, chapelries, &c. having the name of Broughton.*

Broughton has become a suburb of Manchester and Salford and the houses erected here are generally of a superior class

* "BROUGHTON," *Brou-town*. This name is probably derived from Brou, a fore head, or hill rounded like a forehead, and a town, or township, situated upon or immediately under such hill.

ere are many villa residences, detached houses, and terraces. he land is laid out on a most liberal scale, and is let at chief nts varying from 1½*d.* to 6*d.* and upwards per square yard.

LOCAL GOVERNMENT REQUIRED.—It is the wish of the prin- pal proprietors of land, as also of a majority of the inhabitants, at the Public Health Act should be applied, to enable the rate- ayers to form a local Board for purposes of self-government. hat a comprehensive and proper system of sewers and drains ay be laid down; that roads, streets, lanes, courts, yards, &c., ay be drained, formed, paved, and regularly cleansed; that full supply of water may be obtained, and that the general egulation of the township may be placed under competent local uthority.

TABLE of Population, Area of Land, and Annual Value of Property in the Township of Broughton.

Area in Acres of Broughton Parish.	Date.	Number of Houses.	Population	Annual Value.			REMARKS.
				£.	s.	d.	
1,420	1801	174	866		..		Value of real property, as assessed to the property-tax.
	1811	..	825		..		
	1815	..	..	5,082	0	0
	1821	..	880		..		Value as assessed for county-rate.
	1829	..	..	14,528	0	0
	1831	..	1,589	16,802	17	4	
	1835	..	..	21,303	0	0
	1841	720	3,794		..		
	1849	1,108	6,094	49,547	0	0	

ACTS OF PARLIAMENT.—There is no Local Act in force within the district. At present, the power under which the paving and sewerage within the township is carried out, is obtained from the General Highway Act; but certain powers are given by 1 and 2 Geo. IV., c. 47 (7th May 1821, local), s. 1, and by 4 Geo. IV., c. 115 (27th June 1823, local), for supplying Broughton with water. It does not appear, however, that these powers have ever been exercised.

MORTALITY.—According to returns handed in at the inquiry, it appears that for 1840 and 1841 the deaths registered in the township were 1 in 66, or about 15 deaths annually to each thousand of the population.

Broughton stands free from any main thoroughfare; there are few poor in the township, and no common lodging-houses, such as those described in other Reports laid before the Board as existing in other places, where the mortality is so much greater than any average yet published; hence the absence of fever and the moderate rate of mortality in Broughton up to this time.

As, however, it is impossible to suppress poverty, or permanently to banish the poor from any district, it is worthy of consideration

as to how excess of disease shall be prevented. It is not sufficient to wait the generation of fever or cholera, and then only attempt to contend with the plague in its most fatal form. The true remedy is prevention, so far as human means can accomplish it, and such a district as Broughton proper works and regulations may be executed with economy. Wherever cottages have to be erected the site should be drained, the houses should be so arranged that light and external ventilation would be abundant and free; accumulations of refuse for long periods should be prevented; the streets, yards, and courts should, in the first instance, be paved; keeping pigs in improper proximity to the houses should be forbidden, and each cottage should have separate sleeping rooms to provide for a decent separation of the sexes, and each room should have a window capable of being opened. To carry out such regulations as shall ensure health to the poor will be one of the means of securing health to the wealthy. Fever radiates from the site of its development, and afflicts alike the careless and the careful, the dirty and the cleanly. Cholera follows in the track of fever. That fever is not natural to poverty, but rather to filth, is proved by the experience obtained in all well regulated hospital asylums, union-houses, and gaols, let the poor have the same means of cleanliness and fresh air in their cottages as furnished to paupers and criminals, and similar results, in improved health may be expected. Even as a commercial speculation first class cottages will pay a better, because a more permanent percentage than the wretched places at present inhabited by the poor throughout the kingdom, principally because they have no choice but to take the houses in existence. The local authorities of any district will do wisely to set an example to builders and others by erecting model cottages.

GEOLOGY.—Broughton stands on the saliferous system; the new red sandstone forming the basis upon which the alluvium has been laid. To the north the Wigan coal-field is worked, and on the north and east the district is bounded by hills of millstone grit, of considerable elevation. The local deposits have been carefully examined, and most lucidly described by E. W. Binney, Esq., who states:—

“The chief part of the district around Manchester, before it was covered with drift, consisted of upper new red sandstone rock, with slight portions of lower new red sandstone, magnesian marls, and upper red marls, and the hard sandstone and limestone rocks, and cold clay and shales of the coal-fields of Manchester and Pendleton.”

The whole superficial or drift deposit of the district, from St. George's Channel up to the Derbyshire, Yorkshire, and Lancashire hills has been arranged by water, and all geologists are aware that the new red sandstone is a marine deposit. The great carboniferous system has undergone many changes during its formation, the records of which may be partially studied and read in the streets and foot-walks of Broughton and Manchester. The

ripple marks on the flagstones denote an ancient sea-beach, existing within a tidal influence, and which must have had a certain inclination and been exposed to particular currents to produce these markings. They exist in the flagstones of the coal measures, in the laminated drift deposits, and in the new red sandstones, as seen in the quarries at Lymm, at Runcorn, at Weston Point, and at Storton; in all of which places ripple markings, sun-cracks, rain-drops, and the footsteps of reptiles (the chirotherium, &c.) are found associated. This impress of a watery agency is not only seen more or less throughout the whole substance of the rock deposits, but if the drift could be removed the whole surface would exhibit distinct sets of contours, hill, valley, and basin; all having had their origin in the wearing action of water which has put gravel and sand in motion over the surface. This is a fact which few geologists have considered, namely, that any wearing, scouring, or grinding power, as exerted on the more solid strata, is not in the water alone, but rather in the solids carried along with it. Water will undermine a bank of clay or till, and in suspension bear away the substance as mud; it will remove mould, and modify sand banks, as also cause particles of gravel to grind themselves into smoothness and sand; but the great changes seen on the surface of the regular stratification, wherever shaped or bored, is principally due to the motion of fluid and solid combined, excepting in those districts which have been acted upon by ancient glaciers. The leading features of any landscape owe much of their character to the modifying, moulding, and shaping action of water; and the educated eye of the practical geologist enables him at a glance to see this, and also to read and study the skeleton configuration of a county as it existed ages before the birth of our race. No skilled anatomist could more readily describe the osseous structure of any living animal, for the first time presented before him, than the geologist would indicate the skeleton of the visible landscape from its particular and general surface character, and contours. It is important to all parties thoroughly to understand the nature and character of the ground beneath their feet; the farmer may drain and cultivate his land to more advantage; the builder may prepare a better foundation, and erect houses more securely. When the character of the drift, sand, and gravel, is thus understood, wells and cesspools will not be sunk into the same porous subsoil, where they will be as much connected as if a pipe communication were laid from one to the other; sewers and drains will also be so constructed as to pass refuse through them, and not filter it into the stratification until the whole becomes filled with a fermenting poison; and grave-yards will not be enclosed by dwelling-houses, and burials be continued until the whole substance of the soil is converted into a compound of human remains, vitiating alike the atmosphere above and the subsoil beneath. Lower Broughton is in the valley of the Irwell, and the character of the deposit, as described by Mr. Binney, is a bed of coarse gravel, composed of

various sized azoic, palæozoic, and triassic rocks, well rounded, parted with layers of fine sand, and sometimes beds of sand, without pebbles, exhibiting every appearance of having been deposited by water, most frequently stratified, but sometimes unstratified. On the top of this is generally found about three or four feet of silty loam. Higher Broughton consists of a deposit of sharp forest sand, parted with layers of gravel, and having every appearance of being a regular deposit by water. It sometimes contains thin beds of till lying in it. Lower and Upper Broughton may be preserved healthy, if proper means are used to drain the agricultural portions of the land, if all building sites are well sewered and drained, and if cesspools are abolished.

METEOROLOGY.—The whole district around Manchester has a moist atmosphere; the annual rain-fall averaging from 30 to 40 inches. The prevailing winds are from the west and intermediate points betwixt west and south. The rain-fall in and around Manchester is probably above the general average of England, but it is not by any means in excess, as is often asserted. The annual rain-fall at the following named places will prove this. The figures represent a mean of several years' observations.

TABLE OF RAIN-FALL.

County or Kingdom.	Name of Place or Town.	Height above Sea.	Rainfall for 12 Months.
		Feet.	Inches.
Cornwall . .	Penzance	40	43·1
Devon . . .	Plymouth	30	35·7
Berks	Hungerford	320	26·58
Hampshire . .	Gosport	30	30·2
Middlesex . .	London	50	24·8
Northampton . .	Wellingborough	160	24·9
Warwickshire . .	Birminghams	462	26·0
Lincoln	Boston	30	23·1
York	Sowerby Bridge	300	27·2
Cumberland . .	Whitehaven	90	47·0
Westmoreland . .	Keswick	258	60·1
„	Grasmere	180	107·5
„	Seathwaite . . . . .	..	140·6
„	Styehead	1,290	92·8
„	Great Gable	2,925	89·4
„	Sparkling Tarn	1,900	124·0
„	Liverpool	100	34·7
Lancashire . . .	Hyde	320	35·2
„	Bolton	320	49·5
„	Bury	300	41·7
„	Manchester	120	37·3
„	Lanark	600	47·7
Scotland	Glasgow	8	33·6
„	Edinburgh	300	25·6
„	Pentland Hills, Glencorse	734	36·11
„	Dublin . . . . .	..	30·87
Ireland	Belfast . . . . .	..	34·96
„	Cork County . . . . .	..	40·20
„	Derry . . . . .	..	31·12

The greatest depths of rain which are recorded to have fallen at Manchester in one day are, 1844, 1.36 inches; 1845, 1.48 inches; 1846, 0.77 inches; and 1847, 1.20 inches. In the month of July 1845, 1.945 inches of rain fell in Birmingham in little more than half an hour. The heaviest fall yet recorded in this country in so short a time.

The average at Manchester for the four months in winter, November, December, January, and February is 12.2 inches. The four months in spring, March, April, May, and June, 10.2 inches; and the four months in summer, July, August, September, and October, 14.9 inches; making a total of 37.3 inches. It will be observed that there is the largest rainfall in summer, and consequently the atmosphere then contains most moisture, and also most heat. Moisture and heat are known to promote putrefaction in animal and vegetable refuse; and an atmosphere contaminated by the gases thus given off promotes disease—especially fever, and the more rapidly fatal cholera, so that it is most important this state of things should be prevented. A proper system of drains will remove excessive wet from the land, and prevent undue evaporation, which injuriously reduces the temperature, and generates fog. Sewers and drains, if properly laid, will remove all the fluid and semi-fluid refuse from houses, yards, and streets. The solid refuse must be taken away at short intervals, by a proper system of scavenging. Works of drainage properly carried out, will add value to the agricultural land; and actively superintended, they will preserve the town atmosphere comparatively pure and healthy, and if the refuse from the sewers is properly preserved and applied, sold at its fair commercial value, the income will more than pay the whole sewage and scavenging rate. This, however, can only be accomplished by proper management; and strange as it may appear, other nations far excel the English in a practical application of their towns' refuse. In China, from the remotest period, every portion has been stored with care for use. In Belgium the refuse of a town is considered worth 30s. per annum for each adult. The refuse of Copenhagen, in five years, produced a clear income of 10,000*l.* The refuse of Edinburgh is said to produce upwards of 50,000*l.* per annum.

PRESENT STATE AND CONDITION OF THE TOWNSHIP.—The land has principally been let in large plots for houses of a superior class, with wide streets well paved, and generally the houses are detached, and have gardens or grass-plots front and back, so that there are not those injurious nuisances which exist in ill built and overcrowded districts. The township therefore, partly on this account, and partly from the favourable character of the subsoil, the contour of the land, and general wealth of the inhabitants, is healthy. Dr. Wood stated that when he first came to reside in it, about 13 years previous to the inquiry, the low land

was imperfectly drained, and there was a preponderance of rheumatic affections, which had however greatly subsided within the last five or six years. He imputed this favourable change to improved drainage. "Fever was almost unknown in Broughton: he (Dr. Wood) had only known one case of real fever for a period of 13 years. They had no epidemic or endemic diseases, no scarlatina, measles, small-pox, or cholera, except in isolated instances. In 1832, when fever was raging so dreadfully in the neighbourhood, there was but one case at Broughton; and even in that instance the attack was experienced while the patient resided at Shudehill, in Manchester, and was afterwards brought into the township. The general fever of this country, so prevalent in some neighbouring localities, is almost unknown here; principally on account of the great bulk of the population being of that class whose situation in life enables them to possess those comforts and necessaries which fortify the general health, and so enables the constitution to resist the influence of contagion or epidemic poison. There are few poor in Broughton; there are no masses of people congregated together in crowded and ill-ventilated dwellings, half clothed, poorly fed, and worse housed."

EXISTING SEWERAGE AND DRAINAGE.—Of late years considerable progress has been made in the construction of main sewers: but there is no general and comprehensive system of combined sewers and house-drains. Mr. Rutter stated that "until within the last few years there was no main sewer in the township; but one had since been constructed, beginning at the bridge, and extending through the main street up to the Bury-road. A branch sewer had also been made to communicate with this main sewer, along Clarence-street to a point called Bloomsbury; and in 1847 the surveyors, with the concurrence of the owners of property on the road, took upon themselves to construct a sewer to a place where it communicates with a running stream. Latterly the attention of the surveyors had been particularly called to the very offensive state of the district through which the new drains were proposed to be carried, in consequence of the great number of cesspools in the locality. Formerly there was little or no fall between the commencement of the sewer and the river; by an alteration and extension a fall of 12 feet had been obtained."

Mr. Joseph Grave, solicitor, stated "that the sewerage in the neighbourhood of Peru-street, or Athol-place, was very defective."

CESSPOOLS.—Many of the large houses have covered cesspools beneath them, or upon the premises, into which the refuse from water-closets and sinks is turned; and there are many privies, with open cesspools behind and beneath them, where the refuse, such as ashes and leaves of vegetables is thrown, and the accumulation is allowed to go on for months together. The danger to health, and the nuisance arising from these privy cesspool-middens, is very great; and when there is an excessive quantity of vapour in

the atmosphere, but especially in a summer evening or night, the smell arising from middens and cesspools is very palpable to the sense, and to those parties occupying the higher portions of the district, is a disagreeable nuisance. Mr. John Boardman stated that "there were cesspools and small brick soughs, which ran in all directions under the roads, and emptied themselves into ditches by the wayside; these caused much nuisance. Cesspools were common throughout the township; and, in his opinion, they ought to be done away with as soon as possible." Mr. Boardman described the beneficial effects of the new sewers so far as they had been carried out, and parties had availed themselves of them by constructing private drains from their houses into them. The question of cesspools or drains will be entered into in my remarks under the head of "*proposed remedial works.*" See also the Appendix.

EXISTING WATER SUPPLY.—The present water supply is principally obtained from local pumps and wells, which are generally sunk on the premises. Pumps of wood, iron, or lead, are used, as the case may be. The water is hard, as is shown by the analysis made by Dr. Clark, and such water is consequently very wasteful for washing, brewing, making tea, &c. Many houses are furnished with cisterns to retain the rain-water which is used for water-closets, for washing, and for other purposes. It will be explained in the "*proposed remedial works,*" that pumps, wells, and cisterns are most expensive in the first instance, as also in use; and that both well, pump, and rain-water may be contaminated so as to be injurious to health.*

ANALYSIS OF WATER.

Note on Two Specimens of Water from Broughton. By Thomas Clark, Professor of Chemistry in the University of Aberdeen.

These two waters seem to be fair waters for the purpose of drinking, but they are both too hard for domestic use. Their hardness is due to lime salts, together with a smaller proportion of magnesian salts; all the salts present in the Athol-place pump seem to be neutral. In the Griffin-inn pump all the salts seem neutral, except about six grains of chalk. The use of these waters must cause much waste in the consumption of tea and of soap, and in the wear and tear of clothes in washing. It is very desirable that search were made in the neighbourhood of Broughton for a softer water for the use of the inhabitants.

HARDNESS.

	Actual.	Latent.	Total.	Alkalinity.
Athol-place Pump . .	$10\frac{1}{4}$	$+ 5\frac{1}{2}$	$= 15\frac{3}{4}$	0
Griffin-inn Pump . .	$14\frac{3}{4}$	$+ 3$	$= 17\frac{3}{4}$	6

Each degree of hardness stands for as much hardness as a grain of chalk per gallon would produce. Each degree of alkalinity for as much alkalinity (that is, as much power of neutralizing sulphuric or other

* Many persons in Manchester and the district are said to have suffered in their health by drinking water drawn from cisterns lined with lead.

acid), as a grain of chalk per gallon would possess. The actual hardness is due to salts of lime. The "latent" hardness is due to magnesian salts, which, in the presence of such a proportion of lime, have not the power of acting upon soap until farther diluted with pure water.

Marischal College,
13th March, 1850.

(Signed) THOMAS CLARK.

LIGHTING.—The township is lighted with gas from works situated in Salford. The price charged for each public lamp is 2*l.* 10*s.* per annum.

BURIAL GROUNDS.—No complaints or statements were made at the inquiry, to show that there are any objectionable burial-grounds within the township. A new church was opened in 1837, and a burial-ground surrounding it was consecrated in 1839. One interment had taken place within the walls of the church. The local Board, should the Act be applied, will no doubt see to it that intramural interments are not continued to an extent likely to prove injurious. A local cemetery may with advantage be provided so as to prevent any improper extension of interments likely at any future time to prove objectionable; and such arrangements may be made as shall be economical and beneficial alike to rich and poor.

REMEDIAL WORKS PROPOSED.

SEWERAGE AND DRAINAGE.—The evidence given at the inquiry and as detailed in this report, proves that some attention has been directed to the improvement of the township. Sewers have been constructed, and drains have been laid into them, but not to the extent necessary and practicable. To ensure all the advantages to be derived from complete sanitary arrangements in Broughton, a more general system of drainage is required; as also proper cleansing regulations, at short intervals. In a climate so humid as that which prevails in the district around Manchester, every means should be adopted to remove the cause of undue moisture from the subsoil, as also from the surface, and care should be taken to remove all stagnant water; but especially such as is in any way contaminated with refuse from drains, or from any other source. Open ditches should be drained and filled in; old brick-yards and clay-pits should be levelled over, or be protected by railing; and waste land of all kinds should be fenced round, so as to prevent its surface being converted into a public nuisance. A neglected and filthy property is alike injurious to the public as to the adjoining landowner. There are many neglected sites in the township which might be improved; but, as is remarked in a pamphlet, on the climate of Manchester, published by the Manchester Statistical Society, "It is gratifying to state, that a *commencement* has been made in this necessary work, by several proprietors; Mr. Worsley of Platt Hall, and Colonel Clowes of Broughton may be named

I can also state, that the agent for Colonel Clowes is most attentive to the profitable occupation of all the land under his charge, and in this lies the true remedy. It is wasteful neglect of property which produces that which is a nuisance; it is a profitable use which effects a good sanitary condition.

It is not only necessary to sewer and drain, but it is of the utmost importance that the work should be properly laid out, and be well executed. More money is now expended upon partial, imperfect, and nuisance-creating works, than would complete the most efficient works which can be devised. Sewers are constructed many times too large for the work they are required to perform; they are laid at improper depths, and empty their contents in improper places. Branch and house drains are also too large; they are constructed of improper materials, rubble, made of a form most objectionable, square on section, and are laid in such a direction, namely, through the house, as to insure their creating the greatest nuisance, if deposit or a stoppage should take place.

The main outlet sewers should be of a capacity, and at a depth which would prevent flooding in times of heavy rain fall; and the sectional form should be that best adapted to preserve the sewer free from deposit, namely, egg-shaped, for all sewers above 1 foot 6 inches diameter. All branch sewers and house pipe-drains of a less diameter may be circular.

The authorities of Manchester and Salford have recently laid down many secondary and branch drains, but they have committed the great mistake, of not having provided main or outlet sewers, but all the sewers and drains of these large towns pour their filthy and highly contaminated and contaminating contents into the streams and river-courses of the district. The sewers of Broughton also discharge their contents into the river Irwell. No system of sewers can be considered as complete, unless proper arrangements have been made to retain the refuse for profitable conversion into portable manure, or for its application to the land direct, and works capable of converting or applying the refuse may be managed, so as to pay the whole sewage rate, and yield a surplus income besides. At present, from sewage contamination, the condition of every river, natural stream, or water-course, through or around Manchester, is frightful; and as house-drains and water-closets are extended, they will become even more unbearable nuisances. If the total annual loss in life and sickness caused to the inhabitants, could be fully and fairly presented to view, rulers and people would start with horror at the sight, and the remedy would at once be sought out and be applied. Before any system of sewers in Manchester, Salford, or Broughton, can be considered worthy of the name, every portion of the local refuse must be prevented from entering the rivers and streams as at present, and it must be made saleable for agricultural use.

BRANCH SEWERS AND HOUSE-DRAINS.—The best material for these are undoubtedly earthenware pipes; they should be carefully made; the form should be preserved in burning; and in laying them, great care should be taken to make the joints tight. It will defeat one purpose of good drainage, if but joints are laid in porous gravel or sand, and due care is not taken to make all these water-tight. A tile-pipe, 4 inches in diameter, will be sufficient to remove the refuse drainage of the largest house; as, 100 gallons of water are discharged through such a pipe, if laid with a fall of 1 inch in 10 feet, in one minute and a-half; or a 4-inch pipe will pass through it, at this inclination, about 95,000 gallons in 24 hours, which is equal to the daily portion of an annual rain fall of 36 inches flowing from $4\frac{1}{2}$ acres of land.

With respect to drains, the result of both experiment and practice is, that pipes of comparatively small diameter better serve the purposes of drainage than the hitherto large and much more expensive brick and stone sewers and drains. The power of water to remove solids and semi-solids is in proportion to the volume, head, or vertical depth, and the gradient down which it is made to flow. Thus, all these things being the same, a pipe of 4 inches diameter will drain any ascertained area within its capacity, better than a larger sewer; as the power of water to remove solids and semi-solids sent in from house and yard drainage will be the greater the more nearly this pipe is graduated to the volume of water to be sent through it. There are other considerations with respect to house drains which dictate a minimum diameter of pipe, rather than the volume of water to be passed from any one house: as, for instance, the drain from any one water-closet should, until the pipes are more evenly made, be not less than 4 inches internal diameter. But one such 4-inch pipe may have several 4-inch branches, and will remove or take off the drainage of several houses. Experiment and actual experience have proved that such a pipe will be preserved in work, open and clean from refuse sediment; whilst all past experience has shown that the more expensive house-drains of 2 feet, 18 inches, and even those of 12 inches and 9 inches diameter, inevitably choke with sediment and refuse, and ultimately become blocked entirely up; because the volume of water is spread out over a wider area in drains of these larger dimensions, and the whole solid refuse is deposited in them, and much of the thin and stagnant sheet of water evaporates and soaks away. Should there be the slightest imperfection in the traps or junctions of the large rubble-drains, any foul and unwholesome gas which may be generated is gradually but constantly passed into the houses, alike destructive of health and comfort.

All branch drains, where practicable, should be laid up to the backs of the houses, not through them, as by this means the floors and foundations need not be disturbed, and all refuse will be passed

at once direct out of the house. Pipe sewers of the dimensions proposed (4 inches and 6 inches diameter), have been laid complete, at a cost of 1s. 6d. per lineal yard.

Apart from any advantage proper drains offer over cesspools, they are more economical in construction and use, as the following comparative estimates show:—

Estimated Cost of Cesspool for house, say, of 50l. annual rental.

First cost of water tight, cesspool, on the Paris plan, complete, say . . . £25 0 0*

Estimated Annual Cost of Cesspool.

£25 at 7½ per cent. interest of capital,	£.	s.	d.
depreciation, &c.	1	17	6
Annual cost of cleansing cesspool	1	10	0
	<hr/>		
Total annual cost of cesspool	£3	7	6
	<hr/>		

Estimated Cost of Drains complete for house, say, of 50l. annual rental.

10 lineal yards of main drain laid complete, at per lineal yard, say 10s.	£.	s.	d.
10 lineal yards of branch drain, complete, at 3s.	1	10	0
	<hr/>		
	£6	10	0
	<hr/>		

Estimated Annual Cost of Drains.

£6. 10s. at 7½ per cent. interest of capital and depreciation	£.	s.	d.
	0	9	9
	<hr/>		
Total annual cost of drains	£0	9	9
	<hr/>		

Abstract.

Annual cost of cesspool	£.	s.	d.
Annual cost of drains	0	9	9
	<hr/>		
Annual saving in favour of drains	£2	17	9†
	<hr/>		

In these estimates an average cost for the cesspool is set down to make each perfectly water-tight, and a maximum length of drain is taken, many houses of 50l. rental will not require 10 lineal yards of drain, so that the cost would be less than the sum stated. There

* This may be a much greater sum than is now incurred for cesspools, constructed so as to allow the fluid to pass off into the subsoil. But a cesspool on the Paris plan must be water-tight, and would cost the sum named, or even more.

† If only 10s. annually is saved upon 50,000 houses, the result will be a saving of 5,000l., or five times the annual per centage on the sum required for complete outlet intercepting sewers and drains, as given in the estimate at the end of this Report.

will be neither nuisance nor expense arising from properly constructed drains, they will be self-cleansing. Where cesspools do not require annual cleansing, a much greater evil is accumulating, namely, the contamination of the subsoil on which the houses stand.

House-drains to be effective must be properly laid, and carefully jointed. No house-drain should have a less fall than 1 in 60. Good joints will depend as much upon the make of the pipe as upon the skill in laying. The joints should be uniform, fair, even and smooth on the inside, so as to allow a free motion to the material passed into them; and the pipe nearest the surface should diminish slightly towards the upper or entrance end, so that any solid, mischievously or otherwise thrust into a pipe-drain, will not choke it below. But each yard or other open drain must be protected with a grating. The branch to the water-closet will be properly connected and secured to the closet-pipe. Water-closet-sinks, and yard-drains should have a simple syphon-trap in their length. Mechanical traps of all descriptions are expensive; and in action, they are generally found to be inefficient. The down-spouts may be passed direct into the drains without any intermediate trap.

The whole line of sewers and branch drains should be liberally provided with means of ventilation. A vertical pipe or shaft brought up to the centre of the street, and covered with a strong grate will in most instances accomplish this. On the main line of sewer, side entrances may be made at convenient intervals, if the sewers are well formed, and are properly graduated to the area, number of houses, volume of water, and quantity of refuse to be drained, and the outlet is preserved freely open, the sewer will be self-cleansing, and foul gas will not be generated to any injurious extent.

To prevent the refuse from being wasted, as at present, sewage may require to be pumped; and this may be accomplished at a cost little above that now paid for draining marsh-land used exclusively for agricultural purposes. Suppose it should be found necessary to pump the entire volume of fluid refuse drained from Manchester and Salford, the area will not be so extensive as many of the English fens and Dutch flats which are successfully and profitably freed from surplus water.

The following tables will show that large areas of agricultural land are drained entirely by steam-power:—

POWER USED, and COST of DRAINAGE by Pumping in Fen District.

Name of Place Drained.	Containing Acres.	Drained by	
		Engines.	Horse-power.
Deeping Fen, near Spalding, Lincolnshire	25,000	2	{ 80 60
Marsh West Fen, Cambridgeshire	3,600	1	40
Hisserton Moss, with Everton and Graingeley Carrs .	6,000	1	40
Littleport Fen, near Ely	28,000	2	{ 40 30
Middle Fen, Cambridgeshire	7,000	1	60
Waterbeach Level, between Ely and Cambridgeshire .	5,000	1	60
Magdalen Fen, near Lynn, Norfolk	4,000	1	40
Marsh Fen District, Cambridge	2,700	1	30
Netwell Fen, near Brandon	2,400	1	20
Thoham Mere, Cambridgeshire (formerly a lake; the lift is here very great)	1,600	1	40
	85,300	12	540

or about one horse-power to each 158 acres of land, which, making each horse-power to cost 10*l.* per annum, will give a charge of 1*s.* 3¼*d.* on each acre drained.

REMARKS.—To pump the refuse drainage of a town, however, will not be a work of cost, but one of profit; if the refuse is properly dealt with, and is applied to its legitimate purpose in agriculture. It is a most remarkable fact that Englishmen, generally, have yet to learn that they are carelessly, nay, so far as the public authorities are concerned, that they are culpably allowing the means of wealth to be worse than wasted. Secondary sewers and drains are constructed at vast expense, and the refuse is thoughtlessly allowed to pass from them into the nearest natural watercourse, there to generate a monster nuisance; over and around which miasma and fever ever brood; and yet the authorities prosecute and fine individuals for causing nuisances upon their own premises, when probably they have no public or general means provided to avoid the evil: for instance, a person may be fined for a foul privy or yard, when he has no opportunity of erecting a water-closet.

Privies, with large open cesspools and middens, or indeed with cesspools of any description, if crowded in amongst dwelling-houses, are most fertile causes of nuisance and disease; and yet the local acts of Manchester and Salford absolutely require that such erections shall be put up.

The Act 7 and 8 Vic., c. 49 (the Manchester Police Act) provides,

“That the owner of every house to which no sufficient privy or ash-pit is attached, shall provide such fit and proper privy to the same, in such situation, and with such proper door and covering to such privy and also such fit and sufficient ash-pit, in such situation as the council shall consider requisite, for the use of the inmates and occupiers thereof.

The 68th section provides that for every default the owner should “forfeit any sum not exceeding 5*l.*, and any further sum not exceeding 10*s.* for every day during which such default shall in anywise continue unamended.”

Water-closets and proper drains will be self-regulating, and in every respect are they cheaper and better than cesspools (see Appendix, abstract from Mr. Rammell’s report on the cesspools of Paris); ashes and other solid refuse should be regularly removed by the authorities *at short intervals*.

PROPOSED WATER SUPPLY.—No local or individual form of water supply is equal to that which is accomplished by works on a large scale, designed and maintained for general use. One of the best Cornish engines will lift 87,000 gallons of water 100 feet high at a working cost of one shilling. This is 870,000 lbs. raised 100 feet, which is a performance equivalent to the daily labour of 700 hod-carriers (bricklayers’ labourers), working at 3*s.* per day, a cost of 108*l.* 15*s.*, or taking the engine power at 1*s.*, and the percentage on the capital at a similar sum, this will make the cost of raising this volume and weight of water 2*s.*, as against 2,175*s.*, if engine power is 1,087½ times more economical than human labour in its most severe form. This illustration may serve to show that private pumps and wells must be expensive in use, apart from the consideration of their first cost. In fact, it will be a most extravagant waste of labour to use wells or pumps, if they are furnished and maintained free of cost, and the ordinary charge has to be paid for a full supply of water at high pressure.

The question as to how Broughton is to be supplied with water will be for the local Board to consider, should the Act be applied. The corporation of Manchester are at present completing works capable of supplying that town and the whole of the suburban district. The following extract will show upon what conditions the inhabitants of Salford are to be supplied, and some such arrangement may probably be made for the inhabitants of Broughton.

“Town Hall, Manchester, March 11, 1851:

“The corporation of Salford to purchase the estate and interest of Manchester in Salford, and 1,000,000 gallons of water daily for a perpetual annual rent of 5,562*l.* 10*s.* 0*d.*, payable quarterly, from after the 1st day of January, 1851:—

	£.	s.	d.
For the plant (pipes) in Salford, per annum (Redeemable at 20 years' purchase) .	1,000	0	0
Salford to pay for 1,000,000 gallons daily, at 3d. per 1,000 gallons	4,562	10	0
	£5,562 10 0		

“ Manchester to supply a further million of gallons daily, or more, at 3d. per 1,000 gallons if required.

“ This water is brought into Manchester a distance of 17 miles. The whole supply provided for is 30,000,000 gallons each day: about 1,000,000 gallons are disposed of at 3d. per 1,000 gallons, and Mr. Banroft, a member of the town council, stated that ‘ could we sell the remaining, 21,000,000 millions at 1d. per 1,000 gallons, we should be in a prosperous condition.’ The entire cost of the works, new and old, will be about 900,000l.”

PUBLIC WALKS AND RECREATION GROUNDS.—There are no public walks or recreation grounds provided and maintained by the authorities of the township; but no doubt the benevolent and wise examples furnished by the neighbouring towns of Manchester and Salford, will be followed by the authorities and landowners of Broughton. As a question of policy and profit, it is better that land should be liberally appropriated for purposes of health and recreation, and the English people have shown that they may safely be trusted to visit and enjoy parks, museums, and picture galleries.

There are many pleasant sites in the township, on Kersall Moor, and the high land overlooking the valley of the Irwell, where public walks may be constructed.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.—I beg respectfully to present, for the consideration of the Board, the following summary and recommendations, based upon the facts and evidence set forth in this report.

Summary of Conclusions.—1. That Broughton is a “ place ” (a township) having a known and defined boundary. That a petition signed by more than one-tenth of the inhabitants rated to the relief of the poor, and greatly exceeding 30 in the whole, has been presented to the Board, in which the petitioners solicit—

“ The General Board of Health to direct a Superintending Inspector to visit the said township, and to make inquiry and examination with respect thereto, but more particularly with respect to that part thereof which is situate *without* the municipal borough of Salford, with a view to the application of the said Act to such last-mentioned part according to the provisions of the said Act in that behalf.”

2. That there are no local Acts of Parliament in force, but the government of the township is imperfectly carried on under the

general Acts of the country; the roads and streets are regulated under the powers of the General Highway Act; that it is the wish of the ratepayers that the powers of the Public Health Act should be granted; that a local Board may be formed for the several purposes contemplated and provided for in that Act.

3. That the means of sewerage, drainage, and supply of water are at present imperfect.

4. That the burial-grounds do not appear to be in an objectionable condition at present. One interment has, however, recently taken place within the church. A cemetery may be considered necessary to prevent any future evil, and more stringent regulations for the present burial-grounds may be adopted until such a cemetery is formed.

5. That many cesspools have been formed, and that wells and pumps have been sunk in the same porous subsoil, a state of works most improper, and likely to be highly injurious if continued. That to remedy these evils, power to construct household drains is required, as also to obtain a full supply of pure water to the superseding of all local wells, pumps, and house cisterns. That the supply may be at constant service, high pressure, abundant, pure, and cheap.

6. That public power to enclose land out of use is required, also to drain all stagnant water from open pits and ditches, remove all solid refuse at short intervals, and to cleanse and regulate the township generally.

7. That much benefit will arise to the ratepayers if they obtain power to construct the necessary works of outlet drainage, jointly with Manchester, Salford, and the adjoining townships, and if they also reserve the sewage refuse, that it may be applied to agricultural purposes.

Recommendations.—Taking into consideration the wishes of the ratepayers, and the deficient means for local government, as set forth in this report and summary of conclusions, I beg respectfully to recommend that your Honourable Board will grant the prayers of the petitioners, and will allow the Public Health Act 1848 (except the section 50 in the copies of that Act as printed by His Majesty's printers), to be applied to the township of Broughton, except such portion of the said township, as is situated within the municipal borough of Salford.

That the local Board of Health to be elected under the said Public Health Act may consist of twelve persons.

That every person shall, at the time of his election as member of the said local Board, and so long as he shall continue in office by virtue of such election, be resident, as in the said Public Health Act 1848, is required, and be seized and possessed of real or personal estate, or both, to the value or amount of not less than 1,000*l.*; or shall be so resident and rated to the relief of the poor of the township upon an annual value of not less than 35*l.*

That the first election take place within one month after an Order in Council or provisional order shall have been obtained for the application of the Act to the township; and that the annual election to replace the retiring members take place on the first Monday after the 25th day of March in each year.

I have the honour to be,
 My Lords and Gentlemen,
 Your most obedient Servant,
 ROBERT RAWLINSON.

To the General Board of Health,
 &c. &c. &c.

APPENDIX A.

No district has had a larger amount of gratuitous labour bestowed upon it than Manchester and the surrounding townships. Reports have been published setting forth the enormous annual loss to the community from imperfect sanitary arrangements, and schemes have been propounded for getting rid of the contaminating refuse now poured into the several streams and rivers; but, up to this time, no such works have been commenced, excepting by the trustees of the late Duke of Bridgewater, who are erecting steam-engines at their several warehouses to enable them to dispense with the vitiated waters of the river Medlock. In a note, dated August 16th, 1850, Mr. F. Smith states, "We are putting up three more steam-engines, which will, when completed, make seven that the Trustees have erected in order to enable them to dispense with the water of the River Medlock." Now it must be remembered that the Bridgewater trustees are seriously injured by the vitiated condition of the Medlock—directly by the passage of liquid refuse and mud into their canal, where they have a right to comparatively pure water, and indirectly by lessening the passenger traffic over the canal. This, however, is a question of right and law, which may be difficult to settle. The ordinary supply of water to the canal is at present highly vitiated, so as to make it for many miles of its course a public nuisance: all the rivers and streams are in the same condition, and the works of improvement belong principally to the Corporations of Manchester and Salford. In 1845, a report by John Robertson, Esq., surgeon, was published, "On the Amount and Causes of Death in Manchester." In January 1850 a report was published by the Statistical Society "On the Climate of Manchester and the Social Evils produced by neglecting to tile-drain the land in the suburban townships;" and other reports, setting forth the advantages of proper works of improvement, have from time to time been issued by the Local Sanitary Association. Mr. Robertson and Mr. P. Holland may be named as having taken an active part in the sanitary movement. Latterly, the Town Council of Manchester have considered the question of the outlet drainage, but no actual works have been commenced. The following extract from their Annual Report will show the existing state of the question:—

" ABSTRACT FROM REPORT ON MANCHESTER.

" The *Paving and Soughing Committee* present to the Council the following report:—

" Your Committee submit, for the information of the Council, the following summary of the streets paved and completed, and of the lengths of sewers and cross sewers constructed at the expense of the owners of adjoining properties, from October 1847 to October 1848.

	Number of Streets.	Length of Streets.		Length of Sewers.		Length of Cross Sewers and Eyes.		Surface Paved.
		Miles.	Yds.	Miles.	Yds.	Miles.	Yds.	Square Yards.
	58	2	52	0	1,573	0	1,372	22,918
" Work previously completed, from 1830 to 1847, both inclusive—								
	515	37	588	35	371	13	274	617,691
Total .	573	39	640	37	184	13	1,646	640,609 { or about 132½ acres.

" Also, the following statement of the sewers constructed and paid for out of the General Township Police Fund during the same period viz. :—

	Sewers.	Portions of Sewers.	Length of Sewers.		Length of Cross Sewers and Eyes.	
			Miles.	Yds.	Miles.	Yds.
	17	39	2	746	0	1,168

" Completed from 1830 to 1847 inclusive—

	33	360	8	1,440	1	722
Total .	50	399	11	426	2	130

" Under the direction of your Committee there has also been constructed, from October 1847 to October 1848, at the expense of the owners of the adjoining property—

	Length of Drains.	
	Miles.	Yds.
Private drains, by contractors, in connection, or simultaneously, with the sewers	1	1,350
Ditto ditto by our own soughers	0	685
Total	2	275

" During the same period there has been laid down 112 syphon traps to the street grids, and 137 traps to private drains.

" Your Committee submit also a general summary of sewers made from 1830 to 1848 inclusive.

	Miles.	Yards.
<i>Paving Fund</i> — Main sewers	37	184
<i>Ditto</i> — Cross sewers and eyes	13	1,646
<i>General Fund</i> — Main sewers	11	426
<i>Ditto</i> — Cross sewers and eyes	2	130
Private drains	2	275
	<hr/>	<hr/>
Total amount to October 1847	66	901
	58	1,047
	<hr/>	<hr/>
Total amount constructed from Oct. 1847 to Oct. 1848	7	1,614

“ Also a statement of steps, areas, and projections removed or altered in front of properties, and the area added to the footpaths, and the expense incurred and paid out of the General Fund, from October 1847 to October 1848.

	£.	s.	d.
Filling up a cellar area in Mason-street	1	6	11
Alteration of steps at the corner of Fountain-street and Market-street	4	17	6
Removal of areas near Hayward’s Hotel, in Bridge-street	12	8	4
	<hr/>	<hr/>	<hr/>
	£ 18	12	9

“ During the past year about one-half of the main sewers made have been constructed of glazed tubes; and the average prices at which the main and branch drains have been executed, including tubes, excavation, removal of soil, laying of tubes, filling up the cuttings, &c., are here-under stated, and the advantage of increased experience of the tubular system on the part of the contractors and their workmen will be clearly seen from the list of the prices formerly paid for tubular sewers, which is also placed in juxta-position with the prices for which they have been recently contracted.

Size.	Price, 1848.		Price, 1849.	
	s.	d.	s.	d.
20 by 15	10	10	9	3
16 by 12	8	0	6	3
12 by 9	6	3	4	5
8 by 6	3	3	2	9
6 by 4	2	3½	2	4

“ Your Committee have satisfaction in being able to report that the improvements suggested by Mr. Francis continue to be completely successful, and that in no single instance have the tubes given way. The sewer is constructed in less than half the time previously occupied; and from that cause, as well as the smaller aperture which is required in tunnelling, there is much less danger or risk to life and property. The system is now fully developed; the sullage from the surface is conveyed to the main drain entirely by means of glazed tubes—round socketed tubes being used for the vertical parts—and the junctions with the main drain are made with a curve at the side, entering obliquely with the stream into the main.

“ Your Committee estimate the saving effected in the length of sewerage constructed from October 1847 to October 1848 at not less than 2,605*l.*

“ Your Committee further report that, in consequence of some apprehension having been expressed that the *stone-ware* tubes were too thin, they caused Mr. Francis to make the following experiment for the purpose of testing their strength. A trench was dug in the ground, in which three tubes, dimensions 12 inches by 9 inches and $\frac{3}{8}$ ths of an inch thick, and 2 feet long were laid end to end, and 2 feet below the surface of the ground; the tubes were then well packed, and the trench filled level with the ground. Immediately over and upon the earth covering the middle tube a piece of wood, 2 feet by 1 foot, was laid, and on this other pieces of timber, so as to form a scaffold, upon which was afterwards placed 11 tons of pig-iron. The weight pressed the scaffold 4 inches into the ground; but when the tube was dug out it was found uninjured, although slightly displaced by the pressure.

“ Your Committee have for some time past had their attention directed to the fact that, however efficient may be their labours in draining the town, the result, in a sanitary point of view, must be unsatisfactory until the state of the rivers which form the outlets to the sewers is altered and improved. The outlets of the sewers are Shooter’s-brook, the rivers Irk, Medlock, and Irwell. The first-named brook, in its passage through the township, is to a great extent enclosed in a culvert; and it has now become necessary that it should be entirely covered in as far as the extent of the buildings in the north-eastern part of Ancoats; near Clayton-street. The brook, so far as covered in, has been covered at the expense of the owners of the adjoining lands; and your Committee are about to communicate with the owners of the remaining portions, and are not without hope that some satisfactory arrangement may be made. Your Committee have received from Mr. Francis a report on the present state of Shooter’s-brook, and an estimate of the cost of enlarging certain parts of the present culvert and of extending the covering to Clayton-street.*

“ That, so far as the rivers Irk and Medlock are concerned, the evils existing arise mainly from the weirs, which intercept and retain the filth poured from the sewers in stagnant pools, where it is allowed to decompose and fill the vicinage with noxious effluvia.

“ That the most objectionable weirs on the Irk are the two belonging to the Town Mills. There are other weirs higher up, but, being out of the reach of the town, they are comparatively innoxious. Owing to the two weirs belonging to the Town Mills, the waters of the Irk are more impure than those of any sewer in Manchester, and the outlets of many of the older drains are thereby seriously obstructed.

“ In the Medlock the objectionable weirs are more numerous, viz. the first at Knott Mill, belonging to the Bridgewater Canal; the second at or near Messrs. Birley’s mill, Cambridge-street, used to collect condensing water for the steam-engines of the neighbouring mills; the third near Granby-row, used to turn a wheel at the Old Garratt print-works; a fourth near Mayfield Print-works; a fifth near Ancoats Vale Dye-works, and a sixth near Holt Town, used to turn a wheel at Messrs. Broeklehurst’s, Ardwick Lime-works.

* To arch over any natural stream or watercourse, draining a wide district, and to pass a town’s refuse into it, is bad in principle; because the sectional area of such tunnel is generally much too large, and the volume of water flowing down it is variable. Properly graduated intercepting sewers are required even under such circumstances.—
R. R.

“ Your Committee are well aware that, to make any arrangement for the removal of these weirs will be attended with serious difficulties; but are of opinion that the difficulties, however great, will ultimately have to be grappled with, as the evils which result from their existence are continually increasing, and, in consequence of the rapid extension of the use of water-closets, instead of providing privies and ash-pits or cess-pools, will soon become intolerable.

“ Connected with this subject, your Committee are aware that there is an interesting question now occupying the public mind, viz., the best mode of conveying away and disposing of the sewerage of towns.

“ Your Committee are of opinion, that it is practicable to construct culverts along the lines of the rivers named, for the purpose of intercepting from the sewers the ordinary flow of sullage (storm-waters being still allowed to flow into the rivers by the present outlets) which might be converged in one tunnel, to be extended to a convenient distance on the lower side of the borough, BEYOND Throstle Nest, and be there received in tanks or reservoirs, and thence pumped up and distributed by TUBES or otherwise over the adjacent country. Your Committee, however, feel that the economical part of this question has not yet received a satisfactory solution, and they can only watch with interest the operations and experiments that may be elsewhere undertaken.

“ Your Committee have also to report, that they have some time past put in force the clauses of the Sanitary Act, which give compulsory power to construct private drains from lands or premises that may be inefficiently drained; and in every street where a main drain is being constructed, the condition of the drainage of the property on each side is particularly examined.

“ Your Committee have also turned their attention to the state of the passages and courts, and steps are now in progress for draining and flagging many of such courts and passages.

“ Your Committee continue to put down traps at all street grids that are found to be offensive.

“ In concluding their report, your Committee unanimously record the sense entertained of the valuable services rendered by Mr. Francis.

“ It will have been seen that by the use of stoneware tubes, suggested by Mr. Francis, instead of brick sewers,* a saving in one year of upwards of 2,600*l.* has been effected to the owners of property; whilst great economy in time, and saving of risk to life and property, has at the same time been secured.

“ The attention paid by Mr. Francis to the formation, under the provisions of the Sanitary Act, of private drains, where such have not heretofore existed, or have been inefficient, and thereby to secure improved drainage in districts where, by the want of it, the health and comfort of many, especially of the poorer classes of the community, is so likely to be affected, has been such as to merit the high approval of your Committee.

“ On behalf of the Committee,
(Signed) “ ABEL HEYWOOD, *Chairman.*”

There can be no doubt but that “weirs” are objectionable on a

* It will be a mistake to suppose that Mr. Francis is the inventor of earthenware or stoneware tubes; credit for their successful application and use (as recommended in the earliest sanitary Reports drawn up by Edwin Chadwick, Esq., C.B.) is due to him, Mr. Francis, but not for their invention.—R. R.

river which passes through a densely-peopled district, especially where they back up the water so as to prevent drainage; but the great evil is, making natural streams the recipients of sewage. Removing these weirs and arching over these streams will not be improvements, but the reverse, if the waters are still allowed to be contaminated with the sewers. It is, however, gratifying to find that the Committee "are of opinion that the difficulties, however great, will ultimately have to be grappled with, as the evils which result from their existence (the weirs) are continually increasing; and, in consequence of the rapid extension of the use of water-closets, instead of providing privies and ash-pits or cesspools, will soon become intolerable." . . . "Your Committee, however, feel that the economical part of this question has not yet received a satisfactory solution; and they can only watch with interest the operations and experiments that may be elsewhere undertaken."

Dr. Playfair, in a Report made in 1845, has estimated that "in Manchester and Salford there are 3,147 deaths annually in excess; and of these, 1,908 are those of adults above 20 years of age." He also states, "the total *annual loss* of money, the value of adult productive labour in Manchester, is 676,890*l.*; while, in Salford, the annual loss amounts to 200,564*l.*" And he further states, "By the calculations, the data of which I have also given, in order that you may yourselves determine their proper value, I estimate that Manchester and Salford lose every year, by their preventible excess of deaths and sickness, and by the premature termination of adult life, a sum no less than 981,189*l.*" This is an estimate almost too enormous to contemplate; and if a small per centage only on such a sum can be realized, the necessary works of improvement need not, on the plea of cost, be one day delayed. But all experience teaches that the proper application of sewage refuse will yield a clear income over and above the cost of the necessary works and management, as see the following analysis:—

"On October 2nd, 1845, the river Medlock, according to the analysis of Dr. R. Smith, brought down the following substances; and there is no reason for supposing that they were on that day in unusual quantity.

	Per diem.	Per annum.
	Cwt.	Tons.
Potass	178	3,200
Soda	257	4,600
Lime	940	16,900
Magnesia	9	160
Phosphoric acid	71	1,280
Silica (solution)	266	4,800
Alumina (ditto)	18	320
Oxide of iron	124	2,240
Sulphuric acid	444	8,000
Chlorine	151	2,720
Organic matter, 1,355 cwt., containing 6 per cent. of nitrogen; or	80	1,440
Insoluble matter, chiefly silica, alumina, and iron	1,866	33,600

"It will be noticed that five of the most valuable substances for agricultural purposes, viz., potass, soda, silica, phosphoric and sulphuric

acids, are here contained in great abundance, which now run to waste. The Irwell probably brings down twice as much as the Medlock of all these substances.

“The phosphoric acid at present brought down by the Medlock alone is sufficient to supply 95,000 acres of ordinary wheat crops, 184,000 acres of clover, 258,000 acres of potatoes, or 280,000 acres of oats. The silica in solution in the waters of the Medlock would supply 50,000 acres of wheat, and the other elements would respectively supply a still larger extent of cultivation.” The whole refuse of the district would, if applied, supply the vital principles of manure to 285,000 acres of ordinary wheat crops, 552,000 acres of clover, 774,000 acres of potatoes, or 840,000 acres of oats, and the silica in solution in all the waters of the Medlock and Irwell would supply 150,000 acres of wheat, &c.

Such are a few statements relative to this most vital question. There is economy in improvement, there is a large income to be derived from proper works, and there is present sickness, misery, death, and heavy poor's-rates in neglect. How long should the Committee of the Corporation of Manchester continue to “watch with interest the operations and experiments that may be elsewhere undertaken?”

The information contained in Appendix B. will show the result of the cesspool system carried to the greatest possible pitch of perfection. It may be summed up as costly in the first instance, troublesome, offensive, and dangerous to health in use, and in every respect inferior to a proper system of tubular drainage. Manchester, Salford, and Liverpool have each a cesspool system, most rude and imperfect as compared with that of Paris, and consequently more costly in management, and likely to be more dangerous to health. The cesspool system serves this purpose; refuse is retained until it ferments and passes into the dwelling-houses gases of the most destructive kind, and the whole matter which would silently, at once, and without cost, float away in tubular drains to some prepared outlet, must at great inconvenience and cost be removed by human labour at intervals. Cesspools are dangerous when full, but when empty much more so, as there is a larger area, in the foulest sides and bottom, for evaporation, and a larger reservoir for deadly gas.

APPENDIX B.

THE CESSPOOL SYSTEM IN PARIS.

[*Being an Extract from a Paper drawn up by Thomas Webster Rammell, Esq., Civil Engineer and Superintending Inspector.*]

It is the practice in Paris to dispose of all the solid refuse of the houses, with the exception of fecal matter, by depositing it in the streets at night, whence it is removed between midnight and dawn by the scavengers. During all this time, however, the heaps are carefully

turned over by the *chiffonniers*, a considerable body of men, to whom all sorts of odds and ends, such as bones, bits of bread, rags, old pots, broken bottles, &c., &c., have a marketable value.

A great portion of the fluid refuse, including principally water which has been used for culinary or cleansing purposes, is got rid of by means of open channels across the yard and the foot-pavement, which convey it to the street gutter, along which it flows until it falls through the nearest gully into the sewers, and ultimately into the Seine. If produced in the upper part of a house, this description of refuse is first poured into an open shoot branching out of the rain-water pipes, with one of which every floor is usually provided. Iron pipes have been lately much introduced to conduct it across the foot-pavement; these are laid level with the surface, and are made with an open slit of about one inch in width at the top, to afford facility for cleansing them. During the busy parts of the day there are constant streams of such fluids running through most of the streets of Paris, the smell arising from which is by no means agreeable. In hot weather it is the practice to turn on the public stand-pipes for an hour or two, to dilute the matter and accelerate its flow.

With respect to fæcal refuse, and much of the house slops, particularly those of bed-chambers, the cesspool system prevails universally in Paris. These cesspools are of two sorts: 1. Fixed or excavated cesspools; 2. Moveable cesspools.

In early times the excavated cesspools or pits were constructed in the rudest manner, and cleaned out more or less frequently, or utterly neglected, at the discretion of their owners. As the town increased in size, however, and as the permeations necessarily taking place into the soil accumulated in the lapse of centuries, the evil resulting was found to be of grave magnitude, calling for the most prompt and vigorous interference on the part of the authorities. It appears certain that prior to the year 1819 (when a strict *ordonnance* was issued on the subject), the cesspools of privies were very carelessly constructed. For the most part they were far from water-tight, and very probably were generally intended to be so. Consequently, nearly the whole of the fluid matter passed into them drained into the springs beneath the substratum, or became absorbed by the surrounding soil. Not only this, the basement walls of the houses become saturated with this matter, and thus, by evaporation, the atmosphere, more particularly in the interior of the dwellings, became loaded with poisonous exhalations.

The moveable cesspools consist simply of tanks or barrels, which, when full, are removed to some convenient spot for the purpose of their contents being discharged. This form of cesspool, though not leading to the contamination of the soil naturally induced by the fixed cesspool system, may occasion many offensive nuisances from carelessness in overfilling, or in the process of emptying them.

The cesspools vary considerably in foulness, and it is remarkable that those containing the greatest quantity of water are the most foul and dangerous. This is accounted for by the increased amount of sulphuretted hydrogen gas evolved; and is more particularly the case where, from their large size, or from the small number of people using the cesspools, much time is allowed for the matter to stagnate and decompose in them. Soap-suds are said to add materially to the foulness

of the cesspools. The foulness of the cesspools, therefore, would appear to be in direct proportion to the cleanly habits of the inmates of the house. Where urine predominates, ammoniacal vapours are given off in considerable quantities, and although these affect the eyes of those exposed to them, and the nightmen suffer much from inflammation of these organs, no danger to life results. The inflammation from this cause is often sufficiently acute to produce temporary blindness, and the men are thus thrown out of work for days together.

Places of Deposit for Matter withdrawn from Cesspools.

The present produce of the cesspools of Paris amounts to between 600 and 700 cubic mètres a-day. The principal, and until a few years ago, the only, place of deposit for this matter was the *Voirie* of Montfaucon. M. Jules Garnier, in his "Visite à Montfaucon," says, "For more than nine centuries Montfaucon has been devoted to this purpose. It was there that the inhabitants of Paris were in the habit of depositing their filth before the walls of the capital extended beyond what is now the *Quartier Central*. The distance between Paris and Montfaucon was then more than half a league." At Montfaucon the solid portion of this matter is manufactured into a dry manure, called, from its peculiar appearance, *poudrette*. The basins belong to the *commune* of the city, who have been in the habit of farming them, together with their contents, for periods of nine years, to the highest bidder.

The produce of this sale has increased enormously of late.

	Francs.	Sterling per Annum.
In 1808 the sale was effected for	97,000, or about	£3,880
In 1817 " "	75,000	" 3,000
In 1834 " "	165,000	" 7,000
In 1843 " "	525,000	" 21,000

The proceeds are of course appropriated by the *commune*.

There appears, however, to be some disposition on the part of the proprietors of the houses to claim a property in the soil after it is deposited at the *Voirie*, and to the proceeds of the sale; and I have been informed that, at the next letting, it is probable that they will take measures to try this question of right.

In addition to the manufacture of *poudrette*, a considerable quantity of ammonia is extracted from the liquids, about one-third of the whole being passed through some chemical works for the purpose. The right of extracting the ammonia is farmed at present for 3,200*l.* per annum: this farm-rent belongs to the *Fermier-General*.

Increase of Matter in the Cesspools, and proposed Mode of dealing with it.—The rapid increase of the quantity of matter in the cesspools of Paris, with the proportionately increasing expense of extracting and removing it, has during a long series of years engaged the serious attention of the authorities, and many experiments have been made with a view to arriving at some plan for arresting or reducing the evil. Although none of these experiments have as yet realized any adequate practical result, it might be interesting to give a few particulars on the subject of them, which at least will convey an idea of the magnitude of a now admitted evil resulting from a faulty principle, and the difficulty of framing any amendment upon a bad principle which shall not lead to other evils almost as intolerable as that it was intended to avoid. The whole of these observations and experiments tend to show that half

measures of cleanliness are almost worse than useless; and that efficient drainage and water-supply must necessarily go hand in hand.

	Cubic Mètres.
In 1810 the total quantity deposited in the basins of the <i>Voirie</i> amounted to	50,151
In 1811 the quantity was	49,545
In 1812	49,235
Giving an average for the three years of.	49,877

The quantity, as before stated, at present conveyed to Montfaucon and Bondy amounts, according to M. Heloin (a very good authority), to from 600 to 700 cubic mètres daily, giving, in round numbers, an annual quantity of 230,000;

and showing an increase in 36 years of very nearly 400 per cent.

In 1835 the Prefect of Police and the Prefect of the Seine called together a Commission to consider this subject in connexion with the removal of the *Voirie* of Montfaucon. In a Report drawn up by certain members of the Commission, MM. Labarraque, Chevalier and Parent du Chatelet, the principal causes of this increase are stated to be:—

1. The improvements introduced in the construction of cesspools, by which all leakage into the sheet of water beneath the ground, which prevailed almost universally before, is prevented.

2. The more common use of water-closets, constructed after the English principle, which require water to keep them clear, and the greater quantity of water at command by reason of the pipes of the Canal de l'Ourcq.

3. The increased use of baths in private houses, in consequence of the more moderate price at which they are supplied.

The Report states,—

“The expense of emptying the cesspools has increased for some years past in a remarkable manner, and everything proves that it will increase more and more, without its being possible to assign a limit where it will stop.

“In large mansions, where numerous servants are kept, we find already foreshadowed the future state of the cesspools generally. It is not at present as formerly, every four or five years that the cesspools of these houses are emptied; now the operation is performed two or three times in the course of a single year, and in some of them the liquids form nine-tenths of the matter extracted.”

Expense of the Cesspool System compared with that of Tubular Drainage.—I now turn to a consideration of the expense of the cesspool system, as carried out in Paris, and the probable expense of a similar system, applied, in an equally perfect manner, to London. I shall then proceed to compare the expense of the cesspool system with the estimated cost of a system of tubular drainage as set forth in the First Report of the Metropolitan Sanitary Commission; and afterwards very cursorily consider the advantages, in an economical point of view of substituting, in Paris, the latter, a system of drainage for the cesspool system at present in operation.

The first point to determine, in making these calculations, is the actual cost per head of population of the working of the present cesspool system in Paris.

The daily quantity of matter at present withdrawn from the cesspools of Paris is, as before stated, between 600 and 700 cubic mètres; which will give, in round numbers, the annual quantity of 230,000 cubic mètres. At the average price of 9 francs per cubic mètre, this would involve an expense of 2,070,000 francs (82,800*l.* sterling), which sum, it would appear, is paid every year by the house-proprietors of Paris for the extraction of the matter from their cesspools, and for its transport to the *Voirie*.

Dividing this annual quantity of 230,000 cubic mètres by the number of the population of Paris (945,721 individuals according to the last census), we have 243 litres only as the annual produce from each individual. The daily quantity of matter (including water) passing from each person into the cesspool has been before stated to be $1\frac{3}{4}$ litres (3·08 pints), or 638 litres annually. The discrepancy between these two quantities, wide as it is, must be accounted for by the fact of a large proportion of the lower orders in Paris rarely or ever using any privy at all, and by allowing for the small quantity of water made use of in the privies of the inferior class of houses. There can be no doubt that this latter quantity of $1\frac{3}{4}$ litres daily is very nearly correct, and not above the average in houses where a moderate degree of cleanliness is observed. This proportion was ascertained to hold in the case of some barracks in Paris, where the contents of the cesspools were accurately measured, the total quantity divided by the number of men occupying the barracks, and the quotient by the number of days since the cesspools had been last emptied; the result showing a daily quantity of $1\frac{3}{4}$ litres from each individual. The correctness of this estimate too has been confirmed, as M. Heloin assured me, by the experience of the *Compagnie Richer* in the case of private houses.

It has been already stated that many houses in Paris have two or three cesspools each, placed to suit local convenience in different parts of the premises. Supposing the average number to each house not to exceed $1\frac{1}{2}$, and the cost of each cesspool to be 18*l.* sterling, we shall then have a capital of 27*l.* sterling per house sunk in works of construction of cesspools.

Adopting, then, these calculations of the number of cesspools to each house and their cost, and allowing only the small quantity of $1\frac{3}{4}$ litres (3·08 pints) of matter to each individual, the annual cost of the cesspool system in Paris per house containing 24 persons (the average number, according to the census of 1817) would be: for instalment of principal and interest, at five per cent. upon capital sunk in works of construction, spread over thirty years, 1*l.* 12*s.*; for extraction and removal of matter, 7*l.* 11*s.*; making a total annual charge of 7*l.* 3*s.* per house of twenty-four inhabitants; or 6*s.* (nearly) per inhabitant.

Supposing a similar system to be applied to London, and allowing to each house eight inhabitants, and one cesspool of half the capacity of those in Paris, and costing 9*l.*, the matter daily passing into it being limited to the same quantity of $1\frac{3}{4}$ litres per head, the annual cost would be as follows:—For instalment of principal and interest at 5 per cent. the cost of works of construction spread over 30 years, 10*s.* 8*d.*; for ex-

traction and removal of contents of cesspools, *1l. 17s.*; giving a total annual charge of *2l. 7s. 6d.* for every house, or *6s.* nearly for every eight inhabitants.

Upon the basis of the estimates given in the First Report of the Metropolitan Sanitary Commissioners, the cost for works of construction of tubular system of refuse drainage, may be set down at the rate of *4l. 3s.* per house of eight inhabitants; the annual charge of which, upon the principle of paying off principal and interest at 5 per cent. in 30 years would amount to *5s.*, being little more than one-tenth of the estimated cost above given for a similar house, under the cesspool system. It should be observed, however, that in the case of houses situated in low districts, where, in order to effect the discharge of the refuse at a sufficient distance from the site of the city, it would be necessary to pump up by engine-power, an additional charge, amply covered by a rough estimate of *2s.* per house, must be reckoned upon. But even allowing the extra charge for pumping, a very considerable pecuniary balance amounting to more than five hundred per cent. would be found to be due to the tubular over the cesspool system of drainage.

In order to test the accuracy of these estimates I will now refer to evidence recently given before the Board of Health, by three of the officers of the Metropolitan Commissioners of Sewers, who may be supposed to have had the greatest practical experience on the subject.

Mr. Lovick, the Surveyor for the Westminster District, gives the cost of a block of nearly 1,200 houses, of "a medium middle class," in the near Earl-street, and he estimates the entire cost, public and private, of a system of tubular drainage, including water-closet pan, &c., at *4l. 8s.* per house.

Mr. Grant, the Surveyor for the Surrey and Kent District, states the case of a block of 44 houses, of about *15l.* rental, the estimated cost of tubular drainage, exclusive of pans, traps, &c., at *1l. 18s.* per house; in another case of a block of 23 houses, at *1l. 19s. 8d.* per house; another block of 46 houses, at *1l. 8s. 9½d.* per house; and in a fourth block of 46 houses, at *1l. 8s. 10½d.* per house.

Mr. Gotto, Surveyor for the Holborn District, in the case of a block of houses of the inferior class, covering an area of about 9 acres, and situate in Goulstone-street, Whitechapel, estimates the whole cost of private drainage, including the fitting up of existing cesspools, water-closet with stool cock, and kitchen and yard sinks complete, at *3l. 2s.* per house; and the proportion of the expense of main sewers at *1l. 9s.* per house; making a total of *4l. 11s. 9d.* per house. Exclusive of the cost of filling up the cesspools, however, the cost per house would be *1l. 9s. 7½d.* per house, which, added to the proportion of expense of public sewers (*1l. 9s.*), would give *2l. 18s. 7½d.* per house as the whole expense of a system of tubular drainage.

These cases, coming from the quarters they do, will, I think, be sufficiently corroborative of the liberality of the estimate upon which I have argued in a preceding paragraph, of *4l. 3s. 6d.* per house for an ordinary class, for the laying down of a system of tubular drainage.

Even this, however, does not represent the full difference in the expense of the two systems. The cesspool does not receive the benefit that has been used for cleansing and culinary purposes, nor the service of water of the streets and houses, and sewers. Sewers and drains

till to be provided to convey away this portion of the liquid refuse. While with the tubular system of refuse drainage, the same channels that carry away the faecal matter from the houses are open to receive the fluids derived from the other sources that have been mentioned, and one outlay, one system of pipes, one staff of superintendents, will serve for the accomplishment of both objects.

Let us now see whether the tubular system of drainage, the abstract superiority of which I will suppose to be admitted, might not even at this time be applied to Paris, not only without inflicting any increased charge upon the inhabitants, but even with a positive saving to them of a considerable portion of their current outlay for the extraction and removal of the contents of their cesspools. For this is the only point of view in which the comparison may be instituted with any chance of a practical result, in the case of a town already fully provided with a system of cesspools, however vicious and inconvenient that system may have been shown to be. The outlay upon works of construction having already been undertaken and liquidated, it would not be a sufficient inducement to the people of Paris to adopt a new system, to tell them that their money has been badly expended, and that, for a less sum, they might now construct a tubular system of drainage, which would render their cesspools unnecessary for the future. In advocating a change of system to practical men, we must start from the point at which we stand, and it is of importance to show that the absolute current expenses attaching to the existing system, might be made sufficient for the substitution of all works of construction necessary for the improved system, as well as all annual charges for the working of it; and if in addition it can be shown that a balance will then absolutely remain in hand at the end of each year to be carried to the credit of the new system, we offer an amount of inducement, both in increased cleanliness and comfort, and in pecuniary gain, which few rational men would refuse to listen to.

I propose now to show (adopting a very rough estimate), that it would be perfectly feasible to establish a system of tubular drainage in Paris, by the economical use of an annual income, much under the amount at present expended by the inhabitants in the extraction and removal of the contents of their cesspools.

The annual amount so expended in Paris is, in round numbers, over 82,000*l.*

In forming an estimate of the probable cost of laying down a tubular system of drainage in Paris, as founded upon the foregoing estimates, it might be proper to bear in mind a fact already incidentally referred to, viz., that as the houses in Paris are much loftier than those in London, and the average number of inhabitants to each much greater, the average extent of mileage of any sewers or drains to be laid down for their use would be proportionably less per head. Accordingly, we find that the area of Paris is only about one-fourth that of London; or, in proportion to population, one-half. The force of this position would appear to be so obvious that it seems necessary to do no more than make a very casual reference to it, the more particularly, as in the general calculations I am about to make, I do not intend to take advantage of it for the purpose of reducing the estimate of cost of the application of the proposed system.

I shall assume, then, the cost for works of construction in Paris,

where the houses average 24 inhabitants each, to be after the same rate per head as in London, where the houses do not average 8 inhabitants each; namely, about 10*s.* 6*d.* per head, or 12*l.* 12*s.* per house. This for a population of a million, in round numbers, would give a gross outlay for works of construction of a system of tubular drainage of 525,000*l.* or, including a long length of outfall pipe, say of 600,000*l.*; the annual interest of which, at 5 per cent., would be 30,000*l.* Supposing that in the case of one-third of Paris, engine power would be required for the purpose of pumping the refuse, an additional sum of 5,000*l.** (which experience would show to be more than ample) may be allowed for it. Adding to this 5,000*l.* for charges of management, the whole annual expense of removing, by means of a system of tubular drainage, the refuse of Paris beyond the boundaries of the city to a spot where its accumulation would not create a nuisance, would be 40,000*l.*, which being deducted from 82,800*l.*, the actual cost of the working of the present cesspool system (apart from the cost of works of construction) would leave a clear balance or saving of more than 42,000*l.* a-year.

The above calculation is founded upon the present cost of the working of the cesspool system in Paris. It should be borne in mind, however, that of late years this cost has been constantly on the increase (to the extent of nearly 400 per cent. in the last 36 years), and that there is every probability of its still increasing, without any assignable limit. In this view of the case, the saving to be effected by a timely application of the tubular system becomes proportionably more important. As an additional circumstance tending to favour the adoption of a tubular system of refuse drainage in Paris, it should be borne in mind that most of the houses are already provided with pans upon nearly every floor, and with the pipes necessary for conducting the matter below the basement; the only matter of private works remaining to be effected, supposing the public works to have been completed, would be to divert the point of discharge of these tubes from the existing cesspools to the main artery of the system of drainage so laid down in the streets. The refuse would thus on the instant of production be put in course of conveyance to a distance from the town, at the rate of probably about 3 miles per hour, instead of stagnating and fermenting as at present for months together until removed by a complicated, laborious, costly, and offensive process.

From the facts detailed in the above description of the cesspool system of Paris, we may conclude,—

1. That this system, to be well carried out, requires, both in the works of construction and in those of extraction and transport of the faecal matter; most comprehensive and detailed regulations involving wide-extended supervision, and constant, minute, and difficult inspection, to ensure their observance.
2. That with the most perfect regulations and supervision, and their application to the purpose of machines constructed upon scientific principles, the operation of emptying a cesspool is still a nuisance not only to the inmates of the house to which it belongs, but

* I suggest this item of expenditure merely to be on the safe side; though, from general observation of the site of Paris, I think it more than probable that the drains of even the lowest parts of the city might be discharged at a point down the valley of the Seine, sufficiently remote for sanitary purposes, by natural means only. Paris has this advantage over London, that it is placed above the influence of the tide.—T. W.

those of the neighbouring houses, and to persons passing in the street; and that a place of deposit being necessary for the matter extracted, the system unavoidably entails a wide-spreading and most disgusting public nuisance upon some point or other of the environs of the city where it is adopted.

3. That the cesspool system presents an obstacle to the proper extension of the water supply, and consequently represses the growth of habits of personal and domestic cleanliness, with all their immense moral results; and that in this respect it may be said to be inconsistent with a high degree of civilization of the masses of any community.
4. That, compared with a tubular system of refuse drainage, it is an exceedingly expensive mode of disposing of the fæcal refuse of a town, so much so, that even in Paris the existing cesspools might be abandoned, and a system of tubular drainage substituted, for a considerably less annual sum, including interest for capital sunk in works of construction, than is now spent in emptying the cesspools; whilst viewed in connexion with the whole subject of town drainage, it is seen to involve an expense at once serious and altogether useless and unnecessary.

REMARKS.—The extract furnished from Mr. Rammell's report on the cesspool system of Paris is worthy of serious attention, because, rightly considered, many errors may be avoided in the construction of new works. The French engineers have carried their system (the construction and management of the cesspool) to its utmost state of perfection; and the results are shown to be expensive, inconvenient, and dangerous to the inhabitants. A rude and most imperfect description of cesspool prevails throughout the district in and around Manchester; and it is because many persons in authority consider a perpetuation and extension of this system necessary that I have entered upon the question in this Report.* The authorities of no other large town have adopted tubular drains to the same extent as the Corporation of Manchester. Their utility has been fully tested, so that no arguments are needed, as in other places, to urge their use; it is even acknowledged that "intercepting sewers are necessary," and must, "sooner or later, be constructed:" but there is a demur as to applying them at once to the fullest possible extent. To construct a system of intercepting sewers, capable of conveying the whole of the refuse from Manchester, Salford, Broughton, Hulme, Chorlton, Ardwick, Rusholme, and the adjoining townships would probably cost about 100,000*l.*, which sum of 100,000*l.*, at 5 per cent., represents an annual charge upon the whole property of the district of 5,000*l.*† At present the partial and imperfect removal

* The Committee of the Manchester Corporation speak in their report of "the rapid extension of the use of water-closets, instead of providing privies and ash-pits, or cesspools, &c."

† An annual payment of 5000*l.*, levied over the district to be benefited, viz., Manchester, Hulme, Chorlton, Ardwick, Beswick, Openshaw, Cheetham, Salford, Broughton, Pendleton, Rusholme, Moss-side, &c., would not exceed one halfpenny in the pound.—R. R.

of cesspools and middens from part of Salford and Manchester alone costs about 6,000*l.* per annum, irrespective of all that is paid by private individuals, which, directly and indirectly, is many times this amount, and the rivers and streams are polluted to an extent unprecedented in the history of the world. The Seine, where it runs through Paris, is comparatively pure, so that the water is capable of being used for washing clothes, and most of the public baths float upon it. The rivers running through Manchester may, for the sum named, be restored to a similar or even more perfect state of purity.

In calculating on the annual expenditure of 5,000*l.*, no credit is taken for income from the refuse; but most assuredly one may be obtained, and the amount will depend upon the care and skill with which the manufacture of the manure, or its application to the land, is carried out. It is not stating more than facts will support to say that at least the interest upon the capital may be paid at once by the sale of the manure. But this is a question private enterprize will soon set at rest, if public bodies refuse to entertain it. Apart, however, from any such question of income, the purification of the rivers, streams, and watercourses flowing through Manchester must sooner or later be undertaken, even if the cost of accomplishing the work should be estimated at a much higher sum than is here put down; and as the local authorities seem to be fully aware of this fact, the sooner such works are commenced the better will it be for all parties; publicly to execute hundreds of innocent people, annually, would be a sight to fill all minds with horror. In the progress of civilization, death, caused by preventible contamination, will be regarded in some such light.

The great inconveniences and evils arising from a system of cesspools may be summed up as follows:—

1st. **THEIR COST.**—Many cesspools in Paris have cost from 300*l.* to 500*l.* in their construction; such, however, serve for several houses. On the other hand, we find that both in Paris and in this country single houses have several cesspools; and it is probably taking a fair average to say that, where the cesspool system is adopted, such will cost each house much more than drains, and the cleansing of cesspools is an ever recurring annual expense.

2nd. **THE EVILS ARISING FROM THE USE OF CESSPOOLS.**—If cesspools are made perfectly water-tight, as in Paris, they must be capacious to retain the fluid refuse of many weeks. Fermentation and evaporation is constantly taking place, and this increases with age, and the gas forces its way into the surrounding atmosphere to the injury of those who breathe it. If cesspools are made, as in this country, porous, the refuse saturates the subsoil, poisons the wells, and also evaporates into the atmosphere.

3rd. **CESSPOOLS MUST BE EMPTIED AT INTERVALS.**—This process is most dangerous to those employed upon it, as also to the

inhabitants of the house. The corrupt and foul liquid is disturbed, a concentrated gas is liberated, and in Paris men have fallen dead as if struck with lightning. The same fatality has taken place in this country in cleansing foul cesspools and large sewers, which are, in fact, "lengthened cesspools."

Such are a few facts connected with covered cesspools. The following remarks apply to open middens and cesspools, as connected with cottages:—

1st. The privy and cesspool, as at present constructed, are crowded into some space which could be much better occupied by the poor resident. Frequently they are placed beneath a sleeping-room; and generally some of the sitting and bed-room windows, if opened, must open upon or over the midden. The unanimous evidence of medical men proves that such a state of things is powerfully promotive of fevers and other similar diseases, and my own personal inspection has invariably shown the largest amount of disease, vice, and crime in the vicinity of the filthiest places.

2nd. Privies and cesspools not only occupy useful space, but they cost much more than useful drains. A privy and cesspool of the lowest class does not cost less than 10*l.*, and frequently more. A perfect system of drains may be laid down, complete, at a cost varying from 15*s.* to 30*s.* each house, and an effective soil-pan for about 30*s.* These will be self-acting. The cottage privy will require an annual expenditure of from 5*s.* to 20*s.* to cleanse it; no such cost will be incurred by drains and soil-pan closets.

3rd. It is found impossible to erect privies for all the houses in a town, but each room may be drained effectually, and each cottage may have a soil-pan water-closet.

The facts may be put as follows: The liquid refuse of the largest house will pass away completely through a drain four inches in diameter; the solid refuse, ashes, &c., the produce of one day, may probably be contained in a small box, which will, in fact, for many houses, hold the produce of several days, or even a week, and with a properly organized staff of scavengers, as in the west end of London, in Paris generally, and for many of the public buildings and offices of Manchester, all the refuse of this description may be removed at short intervals. By this plan the minimum of space is required, and the least possible nuisance is experienced. With cesspools and middens the facts are, first, large stowage room is required, and, second, a monster nuisance is at all times present; for emptying the cesspool or removing the midden is not cleansing, it is actually creating, for the time, the maximum of nuisance. In the one case the refuse, if removed by drains, is innocuous; in the other case it becomes dangerous to the highest possible degree, because retained.

The following estimate is appended, not as a rigidly accurate document; much previous labour and local examination is required to draw up such a one; but I believe the sums named will

be reduced by such an examination. My object is to point out and indicate the maximum cost of such works; it will be for the local authorities to devise and to execute them. The price per lineal yard is calculated to cover local difficulties in tunnelling, compensation, &c., and to provide cast-iron mains where required.

Estimated Cost of Intercepting Drains for Manchester, Salford, and the District.

	£.	s.	d.
Main outlet sewer, from the site of old Hulme Hall to the banks of the river Irwell, half-a-mile below Throstle-Nest Paper Mills	11,000	0	0
Intercepting tunnel sewer, on the line of the river Medlock, from the Ashton Canal, near Holt Town Reservoir, to the site of Hulme Hall	29,040	0	0
Intercepting sewer along the line of Corn Brook from Burgess Villa, near the London and North-Western Railway, to the main outlet as above	12,320	0	0
Intercepting sewer, from the mouth of the river Irk to the site of Hulme Hall	8,800	0	0
Intercepting sewer along the line of the Irk	5,000	0	0
Intercepting sewer, for the whole of Lower and Upper Broughton, into the sewer at the mouth of the river Irk	1,760	0	0
Intercepting sewers for Salford	20,000	0	0
	87,920	0	0
Add for contingencies, 10 per cent.	8,792	0	0
	96,712	0	0
Works at the outlet, say	3,288	0	0
	£100,000	0	0

The experience obtained in the use of tile pipes ought to prevent the local authorities from committing the error of arching over any natural streams as sewers. The local surveyor will have no difficulty in graduating sewers to their work, if the town's refusal alone is dealt with. On some of the streams a double line of intercepting sewers may be required, one line on each side of the stream. This, however, should be the subject of careful consideration when all the facts and difficulties of the case have been ascertained. If the inhabitants of Manchester are to secure health, with commercial prosperity, the works indicated must be accomplished.